

R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Independent claim 1 has been amended to incorporate subject matter based on claim 7 to clarify that the first flow path is provided on a surface of a substrate and that the second flow path is provided on said (same) surface of the substrate. Claim 1 has also been amended to make some minor grammatical improvements.

Independent claim 27 has been amended to delete the phrase "or between the second substrate and another substrate adjacent to the second substrate" so as to clarify that the first flow path is provided between the first substrate and the second substrate and that the second flow path is provided between the first substrate and the second substrate. Claim 27 has also been amended to make some minor grammatical improvements.

Independent claim 28 has been amended to clarify that the first flow path is provided between two adjacent substrates, of the at least two substrates laminated on each other, and to clarify that the second flow path is provided between the two adjacent substrates, based on subject matter recited in

independent claim 27. Claim 28 has also been amended to make some minor grammatical improvements.

Finally, claims 5, 6, 8, 13-20 and 22-24 have been amended to better accord with amended independent claim 1 and/or to make some minor grammatical improvements and to correct some minor antecedent basis problems so as to put them in better form for issuance in a U.S. patent.

No new matter has been added, and it is respectfully requested that the amendments to the claims be approved and entered.

THE PRIOR ART REJECTION

Claims 1-5, 7-12, 15, 16, 27 and 28 were rejected under 35 USC 102 as being anticipated by USP 6,200,536 ("Tonkovich et al"); claims 6 and 18-26 were rejected under 35 USC 103 as being obvious in view of Tonkovich et al; and claims 13, 14 and 17 were rejected under 35 USC 103 as being obvious in view of the combination of Tonkovich et al and USP 6,428,758 ("Schuessler et al"). These rejections, however, are respectfully traversed with respect to the claims as amended hereinabove.

According to the present invention as recited in amended independent claim 1, a chemical reactor is provided comprises: a first reaction section which has a first flow path which is provided on a surface of a substrate and in which a first

reaction is caused; a heating section which heats the first reaction section; and a second reaction section which has a second flow path which is provided on said surface of the substrate and in which a second reaction is caused using heat of the heating section transmitted via the first reaction section.

In addition, according to the present invention as recited in amended independent claim 27, a chemical reactor is provided which comprises a plurality of substrates including first and second substrates laminated on each other. A first reaction section has a first flow path, which is provided between the first substrate and the second substrate, and in which a first reaction is caused. A heating section heats the first reaction section. And a second reaction section has a second flow path, which is provided between the first substrate and the second substrate, and in which a second reaction is caused using heat from the heating section. As recited in independent claim 27, the second reaction is caused at a temperature which is lower than a temperature at which the first reaction is caused.

Still further, according to the present invention as recited in amended independent claim 28, a fuel cell system is provided which comprises a chemical reactor and a fuel cell which generates electricity using a fuel reformed by the chemical reactor. As recited in independent claim 28, the chemical reactor comprises at least two substrates laminated on each

other, including two adjacent substrates. A first reaction section is provided which has a first flow path, which is provided between the two adjacent substrates, and in which a first reaction is caused. A heating section heats the first reaction section. And a second reaction section is provided which has a second flow path, which is provided between the two adjacent substrates, and in which a second reaction is caused using heat from the heating section. As recited in independent claim 28, moreover, the second reaction is caused at a temperature which is lower than a temperature at which the first reaction is caused.

With the structures of the present invention as recited in amended independent claims 1, 27 and 28, a chemical reactor can be provided which efficiently generates heat with a thin structure.

Tonkovich et al discloses (see Fig. 1a) a structure in which an exothermic reaction is performed in an exothermic reaction chamber 100. Heat from the exothermic reaction chamber 100 is convected through the exhaust chamber 108, and the heat is conveyed by conduction through the containment wall 111 to working fluid in a heat exchanger chamber 114 to raise the temperature of the working fluid. According to Tokovich et al the heat exchanger chamber 114 may function as a fuel vaporizer.

As also recognized by the Examiner, Tonkovich et al discloses providing a second reaction chamber 230 as shown in Fig. 2d.

The Examiner asserts that heat exchanger chamber 114 heats the exothermic reaction chamber 100 according to Tonkovich et al. It is respectfully pointed out that Tonkovich et al actually discloses the opposite relationship between the exothermic reaction chamber 100 and the heat exchanger chamber 114. See column 3, lines 37-42 of Tonkovich et al, which clearly discloses that heat from the exothermic reaction chamber is conveyed by convection and conduction to working fluid in the heat exchanger chamber 114 (which may function as a methanizer or a fuel vaporizer):

(d) heat from the exothermic reaction chamber 100 is convected by an exothermic reaction exhaust through the exhaust chamber 108 and by conduction through the containment wall 111 to the working fluid in the heat exchanger chamber 114 thereby raising a temperature of the working fluid.

In addition, it is respectfully pointed out that second reaction chamber 230 is actually provided as a structure similar to the exothermic reaction chamber 100, while the second heat transfer chamber 220 can be employed to control temperature or to transfer heat.

In any event, it is respectfully submitted that if the exothermic reaction chamber 100 and the second reaction chamber 230 of Tonkovich et al are interpreted as the first

reaction section having a first flow path (element 100 of Tonkovich et al according to the Examiner) and the second reaction section having a section flow path (element 230 of Tonkovich et al according to the Examiner) recited in claims 1, 27 and 28, then according to the Examiner's own interpretation of Tonkovich et al, Tonkovich et al does not disclose, teach or suggest the features of the present invention as recited in amended independent claims 1, 27 and 28.

More specifically, in rejecting original claim 27 on page 4 of the Office Action (item 16 of the Office Action), the Examiner states that Tonkovich et al discloses:

(b) a first reaction section which has a first flow path between the first substrate and the second substrate (100)...and (d) a second reaction section (230) which has a second flow path between the second substrate and another substrate adjacent to the second substrate (emphasis added).

Thus, even according to the Examiner's stated interpretation of Tonkovich et al (which was stated by the Examiner in applying Tonkovich et al to an alternative recitation of claim 27 that has now been deleted in amended independent claim 27), the flow path of the exothermic reaction chamber 100 and the flow path of the second reaction chamber 230 are not provided between the same two substrates.

Therefore, in accordance with the Examiner's interpretation of Tonkovich et al, Tonkovich et al clearly does not disclose,

teach or suggest a first reaction section which has a first flow path which is provided on a surface of a substrate and in which a first reaction is caused and a second reaction section which has a second flow path which is provided on said (same) surface of the substrate and in which a second reaction is caused using heat of the heating section transmitted via the first reaction section, as recited in amended independent claim 1.

Similarly, it is respectfully submitted that Tonkovich et al clearly does not disclose, teach or suggest the features of the present invention as recited in amended independent claim 27 whereby the first flow path of the first reaction section and the second flow path of the second reaction section are both provided between the first and second substrates which are laminated on each other, and wherein the first reaction section is heated by a heating section and the second reaction caused in the second reaction section is caused using heat from the heating section (the second reaction being caused at a temperature which is lower than a temperature at which the first reaction is caused).

Still further it is respectfully submitted that Tonkovich et al also clearly does not disclose, teach or suggest the features of the present invention as recited in amended independent claim 28 whereby the first flow path of the first reaction section and the second flow path of the second reaction section are provided between the same two adjacent substrates which are

laminated on each other, and wherein the first reaction section is heated by a heating section and the second reaction caused in the second reaction section is caused using heat from the heating section (the second reaction being caused at a temperature which is lower than a temperature at which the first reaction is caused).

Indeed, it is respectfully submitted that the structure of Tonkovich et al, whereby, for example, the exothermic reaction chamber 100 has a first shell 102, the exhaust chamber 102 has a second shell 110 and the heat exchange chamber 114 has a third shell 116 (the structure shown, for example in Fig. 1a of Tonkovich et al) clearly does not correspond to the structure of the present invention as recited in amended independent claims 1, 27 and 28, even if the additional chambers 220 and 230 (cited by the Examiner) shown in Fig. 2d of Tonkovich et al are added to the structure of Fig. 1a thereof.

Schuessler et al, moreover, has merely been cited for disclosure relating to temperature sensors, and it is respectfully submitted that Schuessler et al also does not disclose, teach or suggest the features of the present invention as recited in amended independent claims 1, 27 and 28.

In view of the foregoing, it is respectfully submitted that the present invention as recited in amended independent claims 1, 27 and 28, as well as claims 2-6 and 8-26 depending from claim 1,

clearly patentably distinguishes over Tonkovich et al and Schuessler et al, taken singly or in combination, under 35 USC 102 as well as under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,

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